

PATENT

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Joyce Hegeman

Applicant : Jung, Hyun-Sook
Application No. : 09/775,315
Filed : February 1, 2001
Title : POSITIVE ACTIVE MATERIAL FOR RECHARGEABLE LITHIUM BATTERY AND METHOD OF PREPARING SAME
Grp./Div. : 1795
Examiner : Julian A. Mercado
Docket No. : 41671/P849

Confirmation No. 8247

APPELLANT'S BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
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Alexandria, VA 22313-1450

Post Office Box 7068
Pasadena, CA 91109-7068
September 18, 2008

Commissioner:

1. REAL PARTY IN INTEREST

The real party in interest is Assignee, Samsung SDI Co., Ltd.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. STATUS OF CLAIMS

Claims 1-4 and 11 are pending in the application. Claims 5-10 have been canceled.

Claims 1-4 and 11 have been rejected. The rejection of each of claims 1-4 and 11 is appealed.

4. STATUS OF AMENDMENTS

This appeal is taken from a final Office Action of March 11, 2008 which responds to a Supplemental Amendment filed on December 5, 2007.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Claims 1-4 and 10 have been rejected and are appealed. Of these claims, claims 1 and 11 are independent. Claim 1 is directed to a positive active material for a rechargeable lithium battery comprising lithium nickel manganese oxides and lithium manganese oxides in a weight ratio ranging from about 4:6 to about 1:9. *Specification, page 8, lines 1-7.* The lithium nickel manganese oxides may be represented by $\text{Li}_x\text{Ni}_{1-y}\text{Mn}_y\text{O}_{2+z}$, where $0 < x < 1.3$, $0.1 \leq y \leq 0.5$, and $0 \leq z \leq 0.5$. *Claim 2; specification, page 8, lines 8-10.* The lithium manganese oxides may be represented by $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_{4+z}$ where $0 \leq x' \leq 0.3$, and $0 \leq z \leq 0.5$. *Claim 3; specification, page 6, line 23 to page 7, line 1.*

Claim 11 is directed to a rechargeable lithium battery comprising a positive electrode, a negative electrode and an electrolyte. *Specification, page 8, line 14 to page 9, line 18.* The positive electrode includes a positive active material comprising a mixture of lithium nickel cobalt oxides and lithium manganese oxides in a weight ratio less than 1:1. *Specification, page 6, lines 16-21.* The lithium manganese oxides and the lithium nickel cobalt oxides remain distinct chemical species and are bonded together by a first binder adapted to be evaporated. *Specification, page 7, lines 9-22.* The positive electrode also includes a second binder, and a conductive agent. *Specification, page 8, lines 16-22.*

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether the examiner erred in rejecting claim 11 under 35 U.S.C. §103(a) as obvious over Mayer (U.S. Patent No. 5,783,333). Whether the examiner erred in rejecting claims 1-4 under 35 U.S.C. §103(a) as obvious over Pynenburg, et al. (U.S. Patent No. 5,429,890) in view of Hasegawa, et al. (U.S. Patent No. 5,370,948) with evidence from Imachi (U.S. Patent No. 7,056,622).

7. ARGUMENT

In the Final rejection dated March 11, 2008, the examiner rejected claim 11 under 35 U.S.C. §103(a) as allegedly obvious over Mayer (U.S. Patent No. 5,783,333). In addition, the

examiner rejected claims 1-4 under 35 U.S.C. §103(a) as allegedly obvious over Pynenburg, et al. (U.S. Patent No. 5,429,890) in view of Hasegawa, et al. (U.S. Patent No. 5,370,948) as evidenced by Imachi (U.S. Patent No. 7,056,622).

I. Rejection of Claim 11 under 35 U.S.C. §103(a)

In maintaining the rejection of claim 11 as allegedly obvious over Mayer, the examiner asserts that the limitation, "a first binder adapted to be evaporated," is not given patentable weight, and that even if the limitation were given patentable weight, Mayer discloses "a binder such as water is added to the mixture" and then evaporated. March 11, 2008 Final rejection, page 3. Applicant respectfully traverses these arguments.

In failing to give the limitation "a first binder adapted to be evaporated" any patentable weight, the examiner asserts that the binder is ultimately removed from the final product, and that the limitation renders the claim drawn to an intermediate product. However, as noted in the specification, at page 7, lines 15-18, not all of the binder is evaporated and traces of binder may remain in the chemical mixture. As binder remains in the chemical mixture after evaporation, the recitation of a first binder adapted to be evaporated does not render the claim drawn to an intermediate product. Accordingly, the examiner's failure to give the limitation patentable weight was improper.

The examiner also asserts that Mayer discloses that "a binder such as water is added to the mixture" and then evaporated. To support this contention, the examiner points to Column 15, lines 40-61. However, the passage noted by the examiner references the use of deionized water to wash the ground pellets. Column 15, lines 52-56. The washed pellets are then vacuum dried to remove any water-soluble reactants or unwanted products. Column 15, lines 52-56. The water used here is nowhere described as a binder, nor is it discussed as aiding the bonding of the pellets to each other or to any other materials. As such, the water disclosed in Mayer is not akin to the first binder recited in the present claims.

Moreover, the passage cited by the examiner describes an example of the synthesis of LiNiO_2 , and does not discuss making an active material with a chemical mixture of two different oxides. Indeed, the water pointed out by the examiner is used to wash the pellets, and not to help the pellets bond to each other or to any other material. Mayer nowhere discloses the use of water

as a binder, and nowhere discloses the use of a binder in the preparation of the active material, as claimed. Accordingly, applicant submits that claim 11 is allowable over Mayer.

II. Rejection of Claims 1-4 under 35 U.S.C. §103(a)

In maintaining the rejection of claims 1-4 as obvious over Pynenburg and Hasegawa with evidence from Imachi (U.S. Patent No. 7,056,622), the examiner argues that Imachi provides evidence that lithium nickel manganese oxide has a higher discharge capacity at around 145 (est.) as compared to lithium manganese oxide at around 120 (est.). The examiner relies on this disclosure in Imachi and the disclosure in Pynenburg that cell capacity is proportional to the area under the curve of the differential cell capacity dQ/dV vs. voltage in arguing that it would have taken only routine experimentation to determine the claimed ratio of oxides. However, Imachi has an effective date of May 31, 2002, well after the priority date and U.S. filing date of the present application. As such, the examiner's reliance on this reference appears improper.

Notwithstanding the improper use of Imachi in maintaining this rejection, Imachi fails to disclose the unexpected results achieved from the claimed *mixture* of oxides. In particular, while Imachi may disclose that the discharge capacity of lithium manganese oxide is lower than that of lithium nickel manganese oxide, Imachi nowhere describes the mid-discharge voltages and thermal stabilities. As noted in the specification, at page 13, line 1 to page 17, line 1, the cells having ratios of oxides within the claimed range exhibited not only superior discharge capacities, but also superior thermal stabilities and mid-discharge voltages. Those of ordinary skill in the art looking at Imachi would not have expected the claimed mixture of oxides to exhibit these results. Given these unexpected and superior results, the examiner's continued rejection of claims 1-4 is improper.

In addition, the examiner continues to argue that the Declaration filed on March 30, 2007 (i.e., the Declaration of Geun Bae Kim filed March 28, 2007)("the Declaration") is insufficient to establish unexpected and desirable results to overcome the rejection of claims 1-4. Specifically, the examiner asserts that the ratios presented in the Declaration (a copy of which is attached) are not representative of the claimed range. However, the Declaration documents a comparison of a lithium ion battery cell including a positive active material containing a mixture of LiMnO_2 and $\text{Mi}_{1.03}\text{Ni}_{0.8}\text{Mn}_{0.2}\text{O}_2$ in a weight ratio of 2/8 (paragraph 2) and a lithium ion battery cell

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including a positive active material containing a mixture of LiMnO_2 and $\text{Mi}_{1.03}\text{Ni}_{0.8}\text{Mn}_{0.2}\text{O}_2$ in a weight ratio of 6/4. According to the experimental results reported in paragraphs 4 and 5 of the Declaration, a mixture of the oxides in a weight ratio of 2/8 exhibits unexpected and desirable results compared to a mixture of the same oxides in a weight ratio of 6/4. As the Declaration clearly compares a mixture of oxides within the claimed weight ratio range (i.e., 2/8) to a mixture of oxides outside the claimed range (i.e., 6/4), the Declaration is sufficient to establish unexpected results, and therefore to overcome the obviousness rejection.

Moreover, Table 2 of the present specification notes discharge capacities (in mAh/g) of 184, 167, 156 and 152 for positive active materials including the oxides in weight ratios within the claimed range. Additionally, the Declaration notes a discharge capacity (in mAh/g) of 179 for a positive active material including the oxides in a weight ratio of 2/8 (inside the claimed range) and a discharge capacity of 142 for a positive active material including the oxides in a weight ratio of 6/4 (outside the claimed range). In addition, as noted above, the specification notes superior mid-discharge voltages and thermal stabilities of the positive active materials including the oxides in a ratio within the claimed range. Because the specification and the Declaration together provide several weight ratios of the oxides for comparison, the Declaration taken together with the specification constitutes sufficient evidence to establish unexpected results. Given the unexpected results achieved by including the lithium manganese oxides and the lithium nickel manganese oxides in a weight ratio within the claimed range, claims 1-4 are allowable over Pynenburg, Hasegawa and Imachi. Applicant therefore requests reconsideration of the March 11, 2008 Final rejection.

8. CLAIM APPENDIX

1. A positive active material for a rechargeable lithium battery comprising:
lithium nickel manganese oxides; and
lithium manganese oxides,
wherein a weight ratio of lithium manganese oxides to the lithium nickel manganese oxides ranges from about 4:6 to about 1:9, providing an excess of lithium nickel manganese oxides.
2. The positive active material of claim 1 wherein the lithium nickel manganese oxides is $\text{Li}_x\text{Ni}_{1-y}\text{Mn}_y\text{O}_{2+z}$ ($0 < x < 1.3$, and $0.1 \leq y \leq 0.5$, $0 \leq z \leq 0.5$).
3. The positive active material of claim 1 wherein the lithium manganese oxides is $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_{4+z}$ ($0 \leq x \leq 0.3$, and $0 \leq z \leq 0.5$).
4. The positive active material of claim 1, wherein the mixing ratio of the lithium nickel manganese oxides and lithium manganese oxides is 90 to 60 : 10 to 40 wt%.
5. (Canceled).
6. (Canceled).
7. (Canceled).
8. (Canceled).
9. (Canceled).
10. (Canceled).

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11. A rechargeable lithium battery comprising:

a positive electrode comprising:

a positive active material comprising a mixture of lithium nickel cobalt oxides and lithium manganese oxides, the weight ratio of the lithium manganese oxides to the lithium nickel cobalt oxides being less than 1:1, wherein the lithium manganese oxides and the lithium nickel cobalt oxides remain distinct chemical species and are bonded together by a first binder adapted to be evaporated,

a second binder; and

a conductive agent;

a negative electrode; and

an electrolyte.

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9. EVIDENCE APPENDIX

- A. Declaration of Geun Bae Kim filed March 28, 2007.

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10. RELATED PROCEEDING APPENDIX

None.

Respectfully submitted,

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LES/les

Attachment: Declaration of Geun-Bae Kim

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